

We claim:

- 1           1.       A method for patterning a multilayered conductor/substrate structure  
2 comprising the steps of:  
3           providing a multilayered conductor/substrate structure which includes a plastic  
4 substrate and at least one conductive layer overlying the plastic substrate; and  
5           irradiating the multilayered conductor/substrate structure with ultraviolet  
6 radiation such that portions of the at least one conductive layer are ablated therefrom.
  
- 1           2.       The method for patterning a multilayered conductor/substrate structure  
2 of claim 1 wherein the ultraviolet radiation is spatially incoherent.
  
- 1           3.       The method for patterning a multilayered conductor/substrate structure  
2 of claim 1 wherein the ultraviolet radiation has a wavelength in the mid-UV range.
  
- 1           4.       The method for patterning a multilayered conductor/substrate structure  
2 of claim 1 wherein the irradiating step comprises employing an excimer laser to ablate  
3 portions of the at least one conductive layer.
  
- 1           5.       The method for patterning a multilayered conductor/substrate structure  
2 of claim 4 wherein the step of employing the excimer laser comprises controlling the  
3 excimer laser in consideration of how well the at least one conductive layer absorbs  
4 radiation at particular wavelengths.
  
- 1           6.       The method for patterning a multilayered conductor/substrate structure  
2 of claim 4 wherein the step of employing the excimer laser comprises controlling the  
3 excimer laser to image a pattern from a mask onto the at least one conductive layer.
  
- 1           7.       The method for patterning a multilayered conductor/substrate structure  
2 of claim 6 wherein the pattern includes a line gap which is at least as small as 10  $\mu\text{m}$ .
  
- 1           8.       The method for patterning a multilayered conductor/substrate structure  
2 of claim 1 wherein the multilayered conductor/substrate structure further comprises at

3 least one functional layer intermediate the at least one conductive layer and the plastic  
4 substrate, the at least one functional layer comprising an insulating material.

1 9. The method for patterning a multilayered conductor/substrate structure  
2 of claim 8 wherein the irradiating step comprises employing and controlling an excimer  
3 laser to irradiate a portion of the at least one conductive layer such that a portion of the  
4 at least one functional layer therebeneath heats and swells a desired amount.

1 10. The method for patterning a multilayered conductor/substrate structure  
2 of claim 9 wherein the step of controlling the excimer laser comprises controlling a  
3 fluence of the excimer laser in consideration of an ablation threshold level of the at least  
4 one conductive layer.

1 11. The method for patterning a multilayered conductor/substrate structure  
2 of claim 8 wherein the irradiating step comprises employing and controlling an excimer  
3 laser to ablate portions of the at least one conductive layer without completely  
4 decomposing the at least one functional layer therebeneath.

1 12. The method for patterning a multilayered conductor/substrate structure  
2 of claim 4 wherein the excimer laser is part of a projection-type ablation system.

1 13. The method for patterning a multilayered conductor/substrate structure  
2 of claim 12 wherein the projection-type ablation system is configured to project a  
3 broadened laser beam.

1 14. The method for patterning a multilayered conductor/substrate structure  
2 of claim 13 wherein the projection-type ablation system is configured to project the  
3 broadened laser beam onto a patterned mask positioned over but not touching the at least  
4 one conductive layer.

1 15. The method for patterning a multilayered conductor/substrate structure  
2 of claim 14 wherein the broadened laser beam irradiates at least a 50 mm<sup>2</sup>-sized portion  
3 of the patterned mask.

1           16.    The method for patterning a multilayered conductor/substrate structure  
2 of claim 4 wherein the excimer laser is configured to emit light at a discrete  
3 characteristic wavelength.

1           17.    The method for patterning a multilayered conductor/substrate structure  
2 of claim 16 wherein the characteristic wavelength is 308 nm.

1           18.    The method for patterning a multilayered conductor/substrate structure  
2 of claim 16 wherein the characteristic wavelength is 248 nm.

1           19.    The method for patterning a multilayered conductor/substrate structure  
2 of claim 4 wherein the excimer laser is part of an ablation system configured to facilitate  
3 a roll-to-roll production process.

1           20.    The method for patterning a multilayered conductor/substrate structure  
2 of claim 1 wherein the plastic substrate comprises polyethylene terephthalate (PET) ,  
3 polyethylenenapthalate (PEN), polyethersulphone (PES) or polycarbonate (PC).

1           21.    The method for patterning a multilayered conductor/substrate structure  
2 of claim 1 wherein the plastic substrate comprises a polyolefin material.

1           22.    The method for patterning a multilayered conductor/substrate structure  
2 of claim 1 wherein the at least one conductive layer comprises an oxide layer.

1           23.    The method for patterning a multilayered conductor/substrate structure  
2 of claim 1 wherein the at least one conductive layer comprises an indium tin oxide  
3 (ITO) layer.

1           24.    The method for patterning a multilayered conductor/substrate structure  
2 of claim 23 wherein the ITO layer is polycrystalline.

1           25.     The method for patterning a multilayered conductor/substrate structure  
2     of claim 1 wherein the at least one conductive layer comprises an alloy.

1           26.     The method for patterning a multilayered conductor/substrate structure  
2     of claim 25 wherein the alloy is an indium tin oxide (ITO) alloy.

1           27.     The method for patterning a multilayered conductor/substrate structure  
2     of claim 1 wherein the at least one conductive layer comprises a metal-based layer.

1           28.     The method for patterning a multilayered conductor/substrate structure  
2     of claim 1 wherein the at least one conductive layer comprises a silver-based layer.

1           29.     The method for patterning a multilayered conductor/substrate structure  
2     of claim 1 wherein the at least one conductive layer comprises silver and gold.

1           30.     The method for patterning a multilayered conductor/substrate structure  
2     of claim 1 wherein the at least one conductive layer is a multilayered conductive film.

1           31.     The method for patterning a multilayered conductor/substrate structure  
2     of claim 1 wherein the at least one conductive layer, where it has not been etched, has a  
3     thickness between around 10 nm and around 120 nm.

1           32.     The method for patterning a multilayered conductor/substrate structure  
2     of claim 1 wherein the at least one conductive layer has a resistivity of no greater than  
3     80  $\Omega$ /square.

1           33.     The method for patterning a multilayered conductor/substrate structure  
2     of claim 1 wherein the at least one conductive layer has a transmissivity of at least 80%.

1           34.     The method for patterning a multilayered conductor/substrate structure  
2     of claim 8 wherein the at least one functional layer comprises a protective layer which  
3     serves to protect layers beneath the protective layer from laser irradiation.

1           35.     The method for patterning a multilayered conductor/substrate structure  
2 of claim 34 wherein the layers beneath comprise a barrier layer which serves to protect  
3 the plastic substrate from environmental damage.

1           36.     The method for patterning a multilayered conductor/substrate structure  
2 of claim 34 wherein the layers beneath include the plastic substrate.

1           37.     The method for patterning a multilayered conductor/substrate structure  
2 of claim 8 wherein the at least one functional layer comprises a layer of acrylic which  
3 abuts the at least one conductive layer.

1           38.     The method for patterning a multilayered conductor/substrate structure  
2 of claim 8 wherein the at least one functional layer comprises a barrier layer which  
3 serves to protect the plastic substrate from environmental damage.

1           39.     The method for patterning a multilayered conductor/substrate structure  
2 of claim 38 wherein the barrier layer is inorganic.

1           40.     The method for patterning a multilayered conductor/substrate structure  
2 of claim 38 wherein the barrier layer has an oxygen transmission rate (OTR) no greater  
3 than 0.05 cc/m<sup>2</sup>/day.

1           41.     The method for patterning a multilayered conductor/substrate structure  
2 of claim 38 wherein the barrier layer has a water vapor transmission rate (WVTR) no  
3 greater than 0.05 g/m<sup>2</sup>/day.

1           42.     The method for patterning a multilayered conductor/substrate structure  
2 of claim 38 wherein the barrier layer comprises a layer of SiO<sub>x</sub> which abuts the plastic  
3 substrate.

1           43.     The method for patterning a multilayered conductor/substrate structure  
2 of claim 8, further comprising:

- 3 an additional functional layer abutting a side of the plastic substrate that faces
- 4 away from the at least one conductive layer, the additional functional layer serving to
- 5 provide structural protection and/or environmental protection for the plastic substrate.